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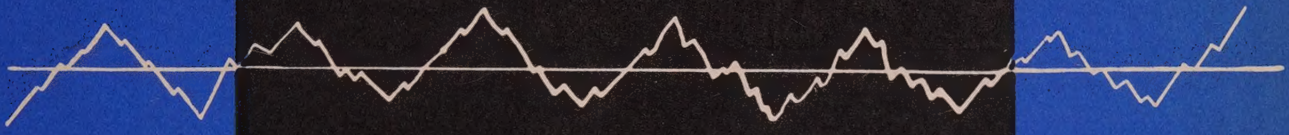

October 1955

FOUNDATION FOR THE STUDY OF CYCLES
New York, New York

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cycles

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VOLUME VI NUMBER 8 OCTOBER 1955

The Director's Letter

Dear Member:

Three and a half years ago the Foundation honored itself by presenting a gold medal to Mr. J. H. Nelson. Nelson, you may recall, is that genius who forecasts radio 'weather'' for R. C. A. Communications, and who discovered that it is the *planets* and not sunspots which are associated with radio fadeouts and blackouts.

The Planets Involved

The idea that the planets could have anything to do with radio weather is too far fetched for any ordinary person to think of. However, as I said above, Nelson is no ordinary person. He is a genius. He rates our respect not only for this fact, but for the fact that, having had his brilliant idea, he proved it true. By using this new-found knowledge he has increased the accuracy of his predictions so that his last one thousand four hundred forecasts have been over 92.6% accurate! And when I say accurate I mean *on the button.*

No one claims that the planets *cause* the radio fadeouts. In fact no one knows how the thing operates or whether it operates directly or indirectly through the sun. It seems likely that the mechanism is electrical, but again, as yet, no one knows *But it does work*!

Cycles Involved Too

Now because the planets move in orbits which are cycles, their interaction creates cycles—albeit complicated ones. It is these cycles that Nelson uses to make his forecasts.

If you contrast the degree of accuracy achieved by Nelson with the reliability of the forecasts (even cycle forecasts!) in other fields you will be as impressed as I am.

Science Means Predictability

Perhaps one measure of the extent to which a subject is scientific is the degree of reliability of its forecasts. A chemist can predict with certainty what will happen when he combines a given amount of one element with a given amount of a second element. The weather forecaster is far less reliable in his predictions. The economist is even less reliable.

The best long range economic forecasts I know about are those of Samuel Benner made in 1873. I have told you about these forecasts time and time again. The significance of the regularities which he observed is uncontestable (although of course not uncontested!).

No theory of any economist has ever produced forecasts to compare with the cycle forecasts of old Mr. Benner. We might therefore say, no economist is as yet as scientific as was Mr. Benner.

A Conference Board Anecdote

You may take exception to my statement that no theory of any economist has worked as well as Benner's cycle forecasts. In this connection a little anecdote may be of interest.

Many years ago a bright young man came to the National Industrial Conference Board and said in effect, 'Why wouldn't it be a good idea to obtain each month from 15 or 20 of the country's leading economists their opinion in regard to what is ahead for business? Then we could pool this information and issue a consensus."

The Conference Board officials agreed that the idea sounded reasonable. They set up a division to carry it out. The young man was employed as director of the division. I was assigned to serve as assistant director. The plan was started. The cooperation of the economists was achieved. Their forecasts were obtained. The consensus was published. But the forecasts were so bad that very shortly the whole idea was abandoned. The division was dissolved.

I always take joy in printing the statement of Presidential Advisor Arthur Burns that economists cannot yet predict the future accurately. It is only fair to match his candor with the statement that cycles analysts cannot yet predict the future with satisfactory accuracy either. But Mr. Nelson—ah, that's something else again! Ninety-two bulls eyes out of one hundred shots. And forecasts as far in advance as anyone wishes!

Note however that Nelson didn't start by grubbing around with cycles. He started with the *principle*. Not that the cycles aren't there. They are. But they are as complex as the finger painting shown on page 253. Without knowing the *laws* that govern it would have been well nigh impossible to unscramble the complexity.

Do these same laws govern human behavior? It's a good question. I do not know. I *do* know that a superficial comparison of daily stock market fluctuations and daily radio weather shows no apparent correspondence.

Cordially yours,

Edward R. Dewey

Director

CYCLES IN RADIO DISTURBANCE

By Edward R. Dewey

IT is the job of J. H. Nelson, Propagation Analyst, Operations Department, RCA Communications, Inc., New York, to forecast when the radio "weather" between New York and Europe will be good, when bad. He forecasts once a day what conditions will be for each four hour period, day and night, to follow. This means about 120 different forecasts a month. Last year his 1416 forecasts averaged 92.2% accurate.

He makes his forecasts by means of a knowledge of cycles. The cycles he uses are irregular in length and irregular in strength. They start suddenly. They stop suddenly. Some of them reverse phase suddenly. However, they are not random. They operate according to law. It may help you in connection with your own cycle studies to know what this law is and how it operates. Perhaps the cycles in which you are interested behave the same way. If they do please let me know.

Radio "Weather"

I have said above that radio communication between New York and Europe is sometimes good, sometimes bad. This is an over simplification of a complicated situation. There are really nine grades of radio "weather." They are graded from 1 to 9 according to the following scale of values: 1, useless; 2, very poor; 3, poor; 4, poor to fair; 5, fair; 6, fair to good; 7, good; 8, very good; 9, excellent. The technical name for these grades is "radio propagation quality."

Radio propagation over long distances depends upon the reflection of radio signals from the ionosphere. The ionosphere is a layer of ionized gas high up above the earth's surface that reflects radio waves. It is born of sunlight.

Whatever it is that affects radio communication is presumably something which affects the ionosphere.

Planetary Configurations

We do not yet know what this "something" is, but Nelson has discovered that it is associated with the angular relationships between the planets as viewed from the sun.

No one yet knows enough about the mechanism to say that the planetary movements *cause* the radio disturbances. We can, however, say that certain planetary configurations (angular relationships) are *associated* with radio disturbances.

The principle of the thing is very simple. Imagine yourself up in space looking down upon the solar system with the sun in the middle and the planets revolving at various distances around it. Draw imaginary lines from the sun to each of the planets. Each of these lines will be distant from each of the other lines by a certain number of degrees (360° representing the entire circle). If, at any instant, any three or more planets are situated in space so that the angular relationship between the lines connecting them and the sun is 15° or some multiple of 15°, the quality of radio propagation will be affected—provided one of the angles is 60°, 90°, 120°, or 180°. There must also be at least two fast moving planets and one or more slow moving planets involved in the configuration for important disturbances. The fast moving planets are Mercury, Venus, Earth, and Mars, the slow moving planets are Jupiter, Saturn, Uranus, Neptune, and Pluto. The fastest moving planet is looked upon as the "trigger" planet. It is as simple as that.

For example, refer to Figure 1 below which shows the three planets Venus, Mercury and Mars. Mercury is shown as being 60° (four times 15°) from Venus, Mars is shown as being 45° (three times 15°) from Mercury. For another example see Figure 2 where Jupiter is shown as 60° (four times 15°) from Mars, Venus is shown as 90° (six times 15°) from Jupiter, and Saturn is shown as 15° from Venus.

Basis of Forecast

The related planets must form a group in which all the angles are multiples of 15°. For example, the situation shown in Figure 3 would not be associated with a disturbance.

The association between planetary configuration of the sort described and radio weather is quite definite. It begins when the trigger planet is within about 1° of the critical angle. It begins to subside when the other fast planet is about 1° past the critical angle.

It is possible to forecast the time of disturbance or impaired radio propagation quality with considerable precision. For instance, as I write (Aug. 5, 1955) Mr. Nelson tells me that tonight between 8 and 12 there is likely to be the beginning of a radio disturbance to last for three or four days.

The more planets that bear these relationships at any one time the greater will be the effect upon radio communication. Thus four planets bearing these relationships are more important than three; five planets bearing these relationships are more important than four; etc.

A conjunction (when two planets are in line with each other and the sun) or any angle that is a multiplesof 15° is associated with a change in radio propagation quality (provided three or more planets are involved), but some angles seem to be more important than others. An angle of 15° is associated with some change; 30° is associated with more change; 45° with more than 30°; 60° with more than 45°; 75°, however, is relatively unimportant, something like 15°; 90° is very, very important; 105°, like 75°, is relatively unimportant; 120° is like 60°; 135° is like 45°; 150° is like 30°; 165° is like 15°; 180°, like 90°, is very, very important. So is 0° (for 360°).

Angles of 15°, 30°, 60°, or 120°, are likely to be associated with favorable change (above normal), when formed by two planets only.

Figure 4 diagrams the relative strength of radio disturbances which are associated with the various angular relationships of three or more planets.

Other Relationships

Nelson finds three other planetary relationships to be of interest.

He has noticed that when any two planets are 144° apart, 2/5 of a circle, this relationship by itself is sometimes important. See Figure 5.

He finds that half of 144°, 72° between any two planets, is of some importance. See Figure 6. (Nelson has not yet done any serious research in respect to either the 144° or 72° angle relationships).

He finds that although 75° by itself, like 105°, or 15°, or 165°, is not very important, when three planets line up in such a way that two of them are 150° apart and the third bisects these 150° angles and is 75° from each, the configuration is important. See Figure 7.

There are two other minor matters that need to be referred to:

1. Because the orbits of the planets are elliptical instead of circular, movements of 15° do not always correspond to the same time interval. For example, at its fastest rate Mercury moves 6°, 19' a day, at its slowest only 2°, 44' a day.

Nelson is often asked if these various configurations occur frequently. They do. The outer planets of course move slowly but the inter planets move very rapidly. They

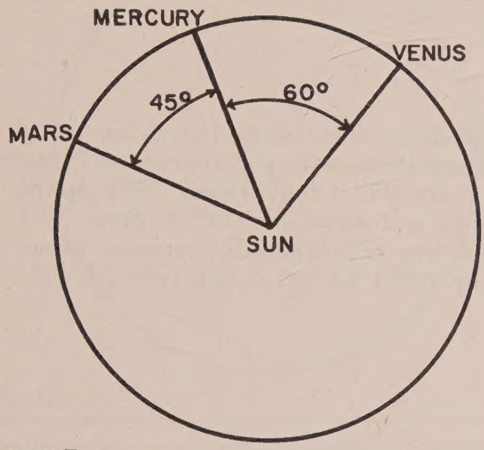

FIGURE 1

Diagram to show Mercury 60° (four times 15°) from Venus; Mars 45° (three times 15°) from Mercury, and 105° from Venus. This configuration will affect the quality of radio weather.

usually create configurations of the sort I have spoken of every few days. Mercury for example on the average moves through 15° every 3.7 days, Venus every 9.4 days, Earth every 15 days, Mars every 28.6 days, etc.

If we did not know the principles governing this behavior and if we had to rely exclusively upon the observation of cycles, our situation in forecasting good and bad radio signals would be as baffling as that which confronts the students of many of the other phenomena here on earth which evidence cyclic behavior. Consider for example a situation where Jupiter and Saturn are 90° apart. On the average, as long as they are within 1° or 2° of this relationship, Mercury will show its influence every 3.7 days. As indicated above, however, these effects will gradually vary in length according to where Mercury is in its orbit. Moreover, also as indicated above, successive cycles will have varying intensity and character depending upon the particular angle of relationship and the number of planets involved. Finally, when

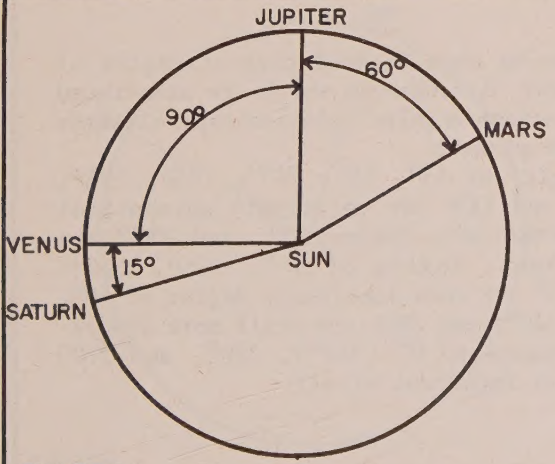

FIGURE 2

Diagram to show Jupiter 60° (four times 15°) from Mars, Venus is 90° (six times 15°) from Jupiter, and Saturn is 15° from Venus. This configuration also will affect the quality of radio weather.

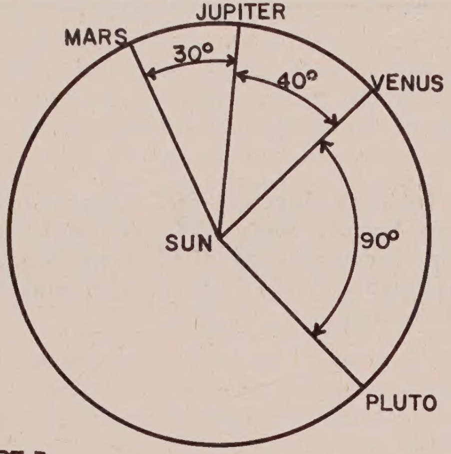

FIGURE 3

Diagram to show a configuration which would *not* be associated with a disturbance. Pluto and Venus are 90° (four times 15°) apart and Jupiter and Mars are 30° (twice 15°) apart, but the relationship between Venus and Jupiter (40°) is not a multiple of 15°.

Jupiter and Saturn have pulled away from each other, the little Mercury induced cycle will vanish even though Mercury keeps on rotating. When Saturn and Jupiter get back into another suitable angular relationship the little 3.7 Mercury cycle will pick up again just where it left off. On the other hand if, in the meantime, Jupiter were to form a satisfactory angular relationship with Neptune the little Mercury cycle will resume, but out of step with the previous Saturn-Jupiter induced cycle.

We have here a counterpart of the complexities that confront the cycle analyst in other fields: Cycles of varying length with varying intensity (amplitudes) which disappear suddenly and which reappear sometime later, sometimes in step with the earlier appearance and sometimes out of step. If I had been forced to study the radio disturbance cycles from internal effects alone I am not sure that I would ever have been able to solve the laws that govern their behavior.

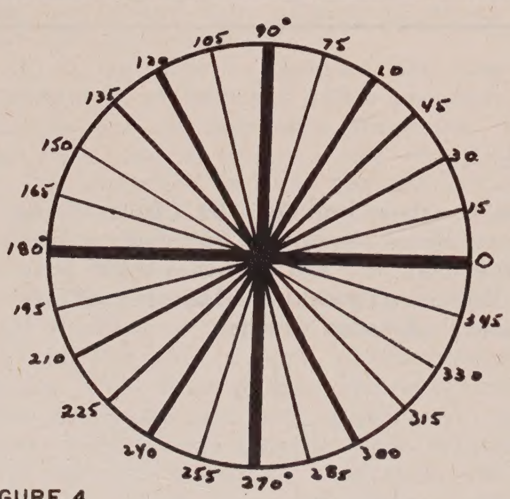

FIGURE 4

Diagram to show the relative strengths of the radio distrubances which are associated with various angular relationships of three or more planets.

Angles of 15°, 75°, 105°, 165°, 195°, 255°, and 345° are relatively unimportant Angles of 30°, 150°, 210°, and 330° are important. Angles of 45°, 135°, 225°, and 315° are more important. Angles of 60°, 120°, 240°, and 300° are still more important. Angles of 0° (360°), 180°, and 270° are most important of all.

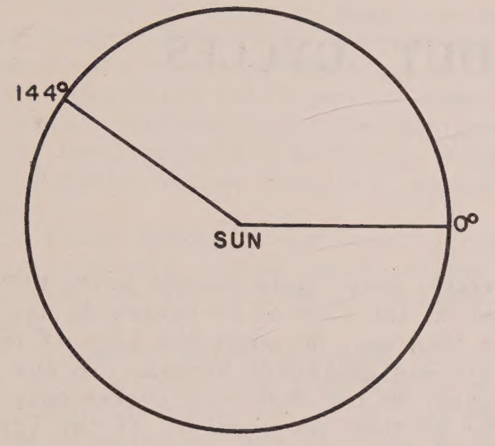

FIGURE 5

Illustration of the 144° angle (2/5ths of a circle) which by itself seems to be important.

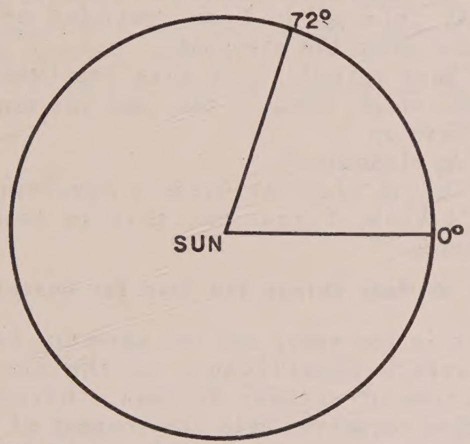

FIGURE 6

Diagram of the angle of 72° (half of 144°) which also seems to be important.

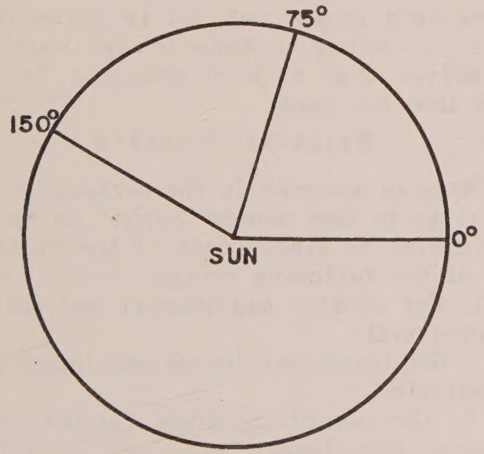

FIGURE 7

Diagram of another important configuration. Two planets are 150° apart, and the angle between them is bisected by a third planet at exactly 75°.

A NEW IDEA ABOUT CYCLES

IT may be time to enlarge our mental horizons in regard to cycles.

Rigid Lengths?

Hitherto most students have considered that rhythmic cycles are of fixed average length. For example, we speak of the 9.6-year cycle of lynx abundance, the 11.15-year cycle of sunspot numbers, the 5.91-year cycle of cotton prices.

Of course we do not expect each wave to be exactly as long as the average length. Accidental distortions or the influence of other cycles will make any single individual wave longer or shorter. However we do usually assume that there is a true length and that, as we average more and more cycles together, we will get closer and closer to it.

Fixed Strengths?

Similarly most students have assumed that cycles have a fixed average strength. For example, we speak of the 9.2-year cycle in pig iron prices as having an average strength or amplitude of 112,2% of trend at time of crest. Similarly for the various other cycles.

This method of thinking about cycles may stem from the analogy of the annual weather cycle. There *is* a true length of the year, even though the time between the hottest day of one year and the hottest day of the year following may vary considerably Also there is, for any given place (although with somewhat less exactness) an average normal temperature and an average departure from normal for various parts of the cycle.

Do Cycles Vary?

Cycle students do not adopt the idea of rigid or fixed length and/or amplitude because of any conviction that this is the way cycles must necessarily behave. To the contrary, every cycle student knows that at least on the face of it cycles do *not* behave this way. We adopt the idea of rigid length and amplitude because, in our ignorance, we can deal with cycles only insofar as they are regular. If the irregularities are regular we can of course take them in our stride, too, but they are not—or are they?

At this point I am reminded of the riddle about the elephant:

"What animal is it that has tusks, a trunk, weighs about a ton, and has wings?"

"Give up."

"An elephant."

"But an elephant doesn't have wings."

"I know, I just put that in to make it harder!"

Have We Made Things Too Hard for Ourselves?

It is too easy, and too patently false, to attach significance to the irregularities of cycles. We have, therefore, saddled ourselves with the concept of perfectly regular *average* behavior in order to make things harder for ourselves. This may indeed be the way things are. On the other hand it may not. It is conceivable that in trying to make things hard for ourselves that we have gone too far and made them too hard.

Rejected Concepts

There is not room in the notions of most of us as to how things "ought" to be for a cycle to be significant if the waves do any of the following things:

1. Get shorter and shorter and shorter progressively.
2. Get longer and longer and longer progressively.
3. Get shorter, then longer, then shorter, then longer, etc.
4. Have one wave length for a few repetitions, them another wave length for a

few more repetitions.

5. Reverse suddenly so that tops come where bottoms "should" be, and vice versa. (When cycles reverse *gradually* i.e. fade out and gradually return upside down, we can explain the behavior as the interaction of two regular cycles of closely related wave length. Not so when the change is sudden.)

6. Cease suddenly and then, after a while, suddenly resume again, either in step with the old pattern or perhaps out of step with it.

7. Evidence, all of a sudden, three or four waves during a period of time in which we normally have two; or two or four waves during a period of time in which we normally have three, etc.

8. Vanish for a while, then resume very close together for a while so that, in the period, there are the "right" number of waves, but all bunched.

9. Fade out and disappear as we go either forward or backward in time.

When we observe behavior of these sorts we say, "No real self respecting cycle would behave this way. We must be observing random behavior of one sort or another." But in all cases is the behavior necessarily random? Are we conceivably overlooking something of importance?

The Dilemma

The dilemma is this: The concept of perfect regularity often fails to explain the facts. On the other hand if we let go of this concept, we have nothing to tie to and in the present state of our ignorance, are completely lost.

My point here is that perhaps, by looking, we could find something else to tie to beside the concept of absolutely regular cycles. If so, it would not only increase our forecasting ability, it would also throw light upon cause.

THE 6-YEAR CYCLE IN GENERAL MOTORS SALES

PRIOR to World War II, the annual unit sales of General Motors passenger cars and trucks showed a clear 6-year cycle. However, the record is so short that there are only three repetitions of the cycle during this period. Even though the three pre-war peaks are all well spaced and regular enough to constitute a definite pattern, three repetitions of the cycle are not enough to rely on. (*Many* repetions are *always* necessary to give confidence of significance.)

During the war there were of course no cars produced.

Cycle Now "Upside Down?"

Since the war there has been one clear cut 6-year cycle, but the timing is exactly opposite to that of the pre-war period. Lows came where there "should" have been highs and vice versa.

The fact that the 6-year cycle in the unit sales of General Motors is upside down relative to what it was before World War

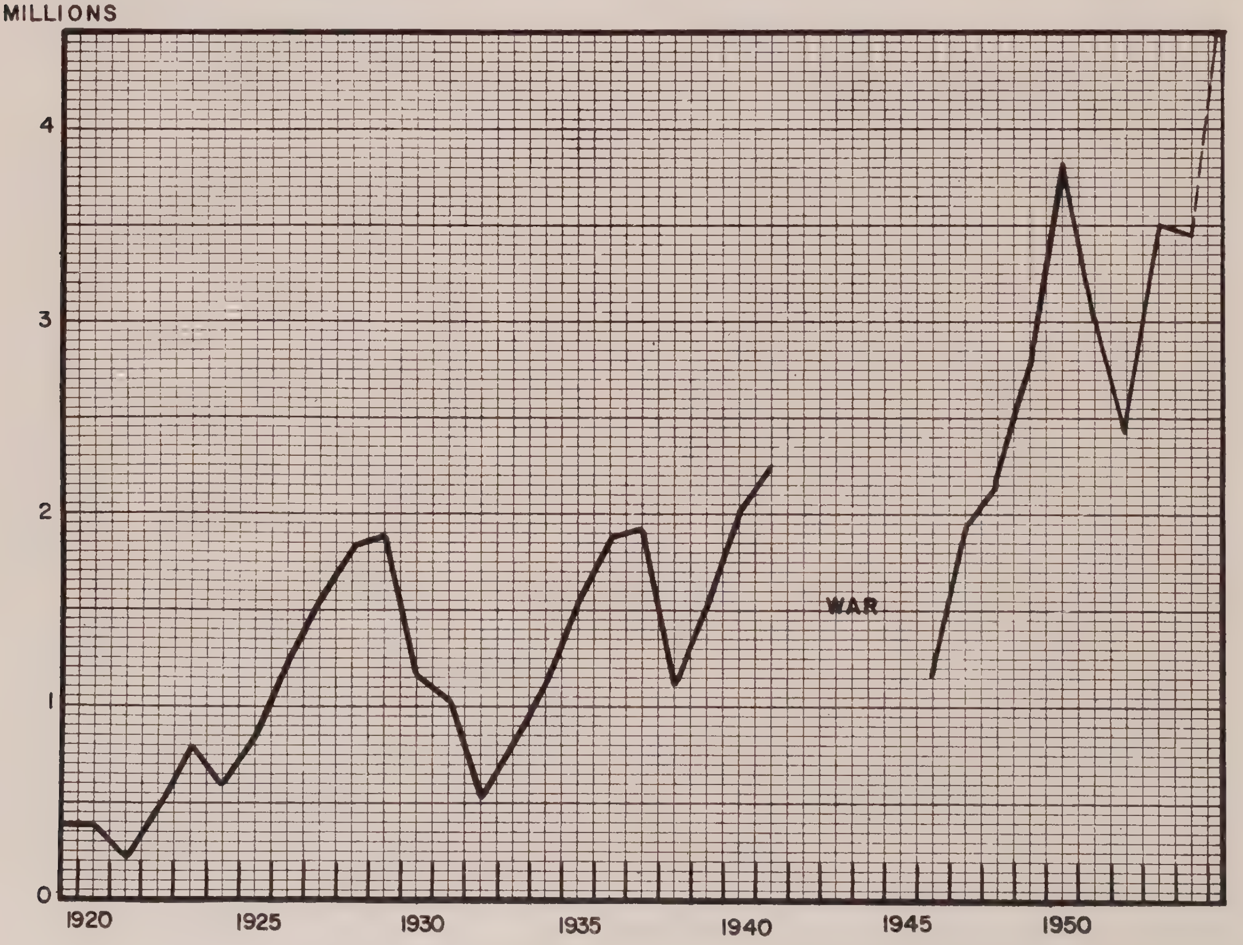

Fig. 1. General Motors unit sales of cars and trucks, 1919--1954. Together with estimate for 1955.

II, could mean any one of three things:

Old Cycle Overwhelmed?

One. It could mean that the 6-year cycle—so clear prior to the war—is continuing as an underlying force, but that it has been completely overwhelmed, first by World War II, then by the pent up demands resulting from World War II, and finally by the Korean War.

An argument in favor of this idea lies in the fact that in other series of figures—not so badly disturbed by war—the six-year cycle is continuing.

If this is the explanation, we can expect that, *in the course of time* the 6-year cycle in General Motors Unit sales will revert to its old pattern.

New Cycle Formed?

Two. The fact that the 6-year cycle in General Motors unit sales is upside down relative to pre-war patterns could mean that this 6-year cycle is a dynamic pattern which starts off afresh after any serious distortion.

In this event, we can expect the present "upside down" pattern to continue.

Cycle Merely Conicidence?

Third. It could be that the pre-war and the post-war behavior show 6-year patterns merely as a result of coincidence. In other words that there is no significance to this 6-year cycle in these figures.

If this is the true explanation we would not expect this 6-year cycle to concinue at all, either ‘right side up’’or “upside down,” except as a result of further coincidence.

I see no way of telling, at this time, which of these three explanations is the correct one. I think we must wait and see.

In spite of these negative conclusions I think it will interest you to see the facts upon which they were based.

Table 1 gives you the data.

Fig. 1 plots these data on ordinary arithmetic grid.

Fig. 2 plots the same data on ratio ruling. A grid of this sort shows the cycles better because equal percentage changes are represented on the chart by equal vertical distances. Fig. 2 also shows trend (a 7-year moving average, extrapolated).

Fig. 3 shows percentages by which the data above and below trend. It diagrams the 6-year cycle as it was and as it is.

E.R.D.

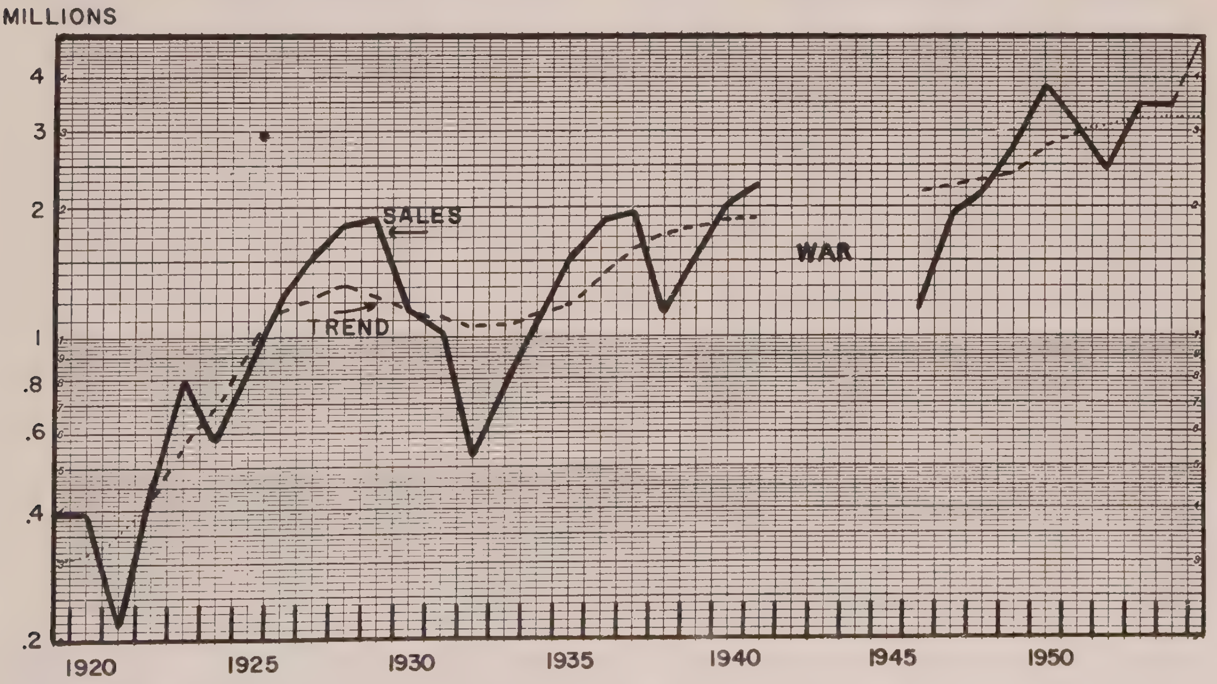

Fig. 2. Ratio chart of General Motors Sales and the 7-year trend of sales. Broken line shows trend.

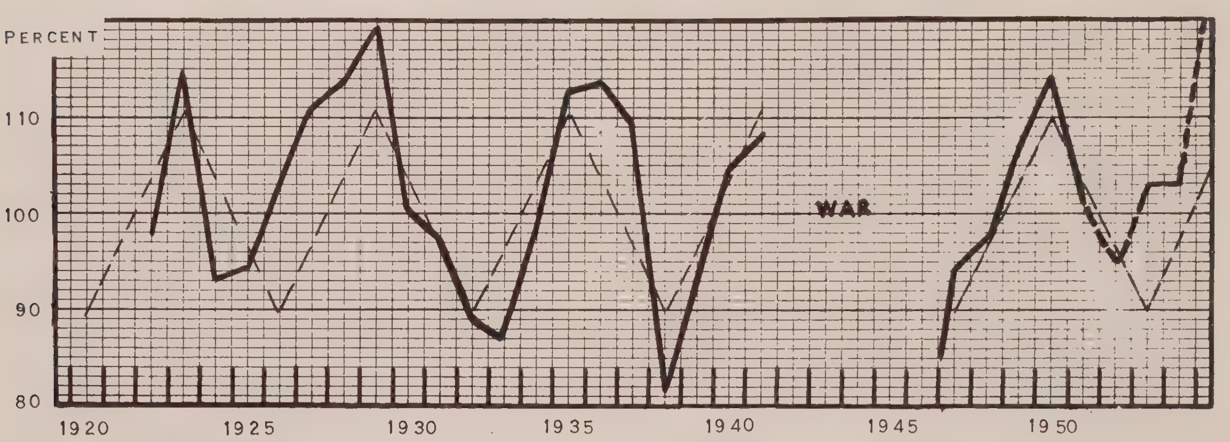

Fig. 3. General Motors Sales—departure of data from trend.

GENERAL MOTORS UNIT SALES OF PASSENGER CARS AND TRUCKS, 1919-1954
To Dealers in the United States and Canada
(To the Nearest Thousand)

Year	Unit Sales	Year	Unit Sales	Year	Unit Sales	Year	Unit Sales
1919	392	1928	1,811	1937	1,929	1946	1,175
1920	393	1929	1,899	1938	1,108	1947	1,931
1921	215	1930	1,158	1939	1,543	1948	2,146
1922	457	1931	1,034	1940	2,025	1949	2,764
1923	799	1932	526	1941	2,257	1950	3,812
1924	587	1933	802	1942		1951	3,016
1925	836	1934	1,128	1943		1952	2,434
1926	1,235	1935	1,564	1944		1953	3,496
1927	1,563	1936	1,867	1945		1954	3,450

THE 3 1/2- TO 3 3/4-YEAR CYCLES IN CORN PRICES, 1720 — 1954

YOU have probably heard of the so called 4-year cycle in corn prices. This article will tell you more about it.

Even the most casual study of a chart of corn prices 1720 to date shows evidence of a cycle a little less than four years long which repeats time after time with reasonable regularity. Five minutes study is enough to show you that its length is about 3 2/3 years.

Eight Questions

The questions before us are:

1. Does this cycle average out to exactly the same length (and strength) in the different parts of the curve?
2. If so, what is this length (and strength)?
3. Is there anything else in nature that has a cycle of this exact length?
4. If the length of the corn cycle varies from generation to generation what is the nature of these variations?
5. Is there any system or regularity to the variations? That is, is the cycle short, long, short, long in any regular way? Every 60 years, for example?
6. Is there anything in nature that has similar variation in wave lengths?
7. What light, if any, do these facts throw upon *cause*?
8. What light do the discovered facts throw upon the probable future price of corn and other commodity prices which behave in the same way?

Let us try to answer these questions.

The Data

With a few minor exceptions, corn prices are available by month from 1720 to date.[1] An index of these prices is charted as Curve A of Fig. 1.[2]

Fig. 1, also shows trend.[3] Trend is shown by a broken line, marked B.

Fig. 1, Curve C, shows the percentages by which the actual prices are above or below the trend.

The Deviations

These percentages are called *deviations* because they show the amounts by which the prices for individual months *deviate* from trend. If you compare Curve C with Curve A you can see that each wiggle in Curve A has its counterpart in Curve C.

There are a powerful lot of months from January 1720 to December 1954, 2820 to be exact. It will simplify computation and charting if we combine each six monthly deviations into a semi-annual deviation.[4] These semi-annual deviations are shown in Fig. 2.

Fig. 2 of course contains a lot of random values as well as our 3 2/3-year cycle. If this were not so, the cycle would be *perfectly* regular and everyone would know all about it. The problem before us is to minimize the randoms without disturbing any regular up and down cyclic element which may be present in the figures. This is very easy to do. To see how it is done, consider the homely example which follows.

Average Cycles

Suppose you were in the ice cream

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[1] FOOTNOTES REFER TO ADDITIONAL INFORMATION, OF INTEREST ONLY TO THE TECHNICIAN, AVAILABLE AT THE END OF THE ARTICLE.

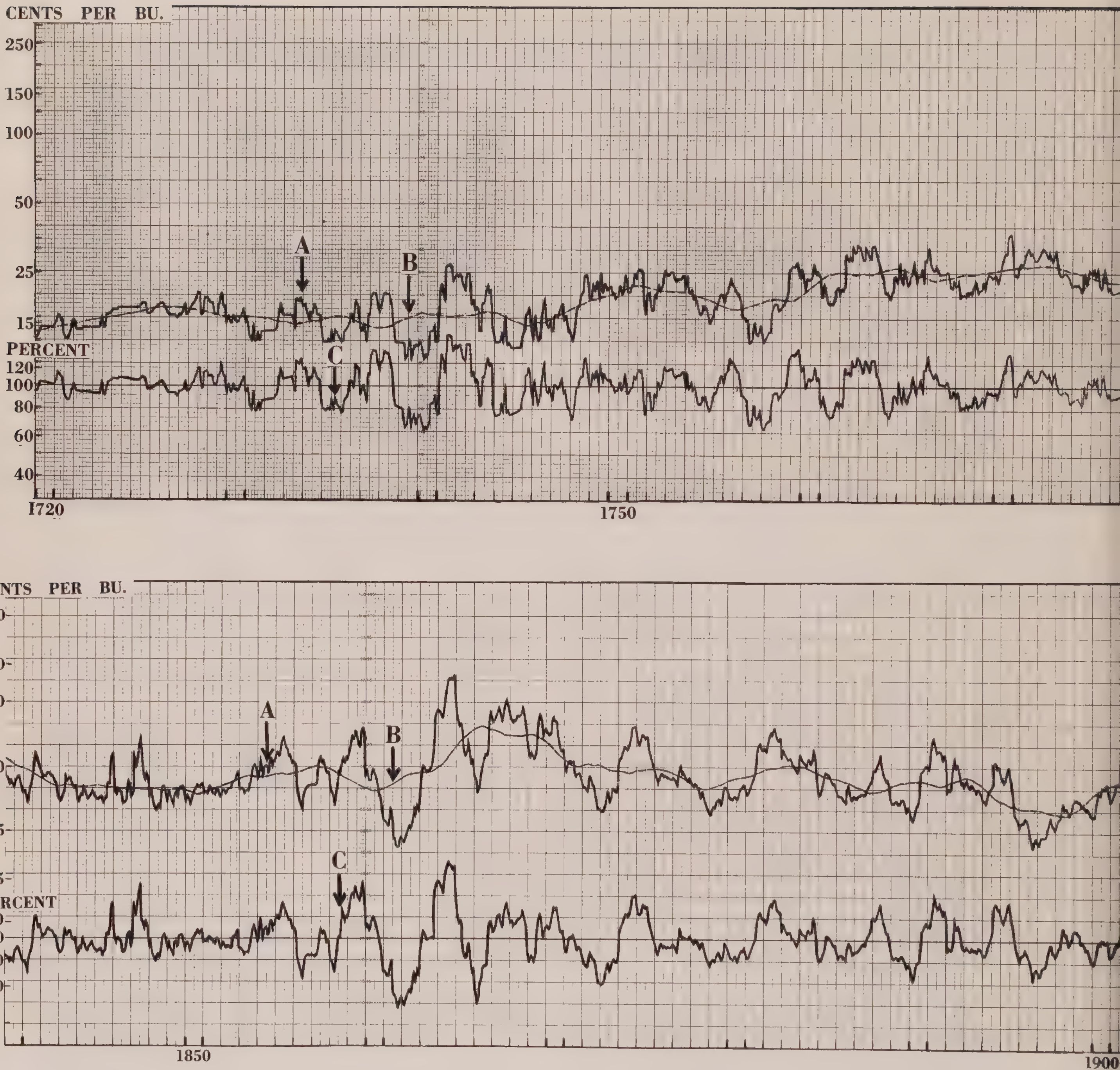
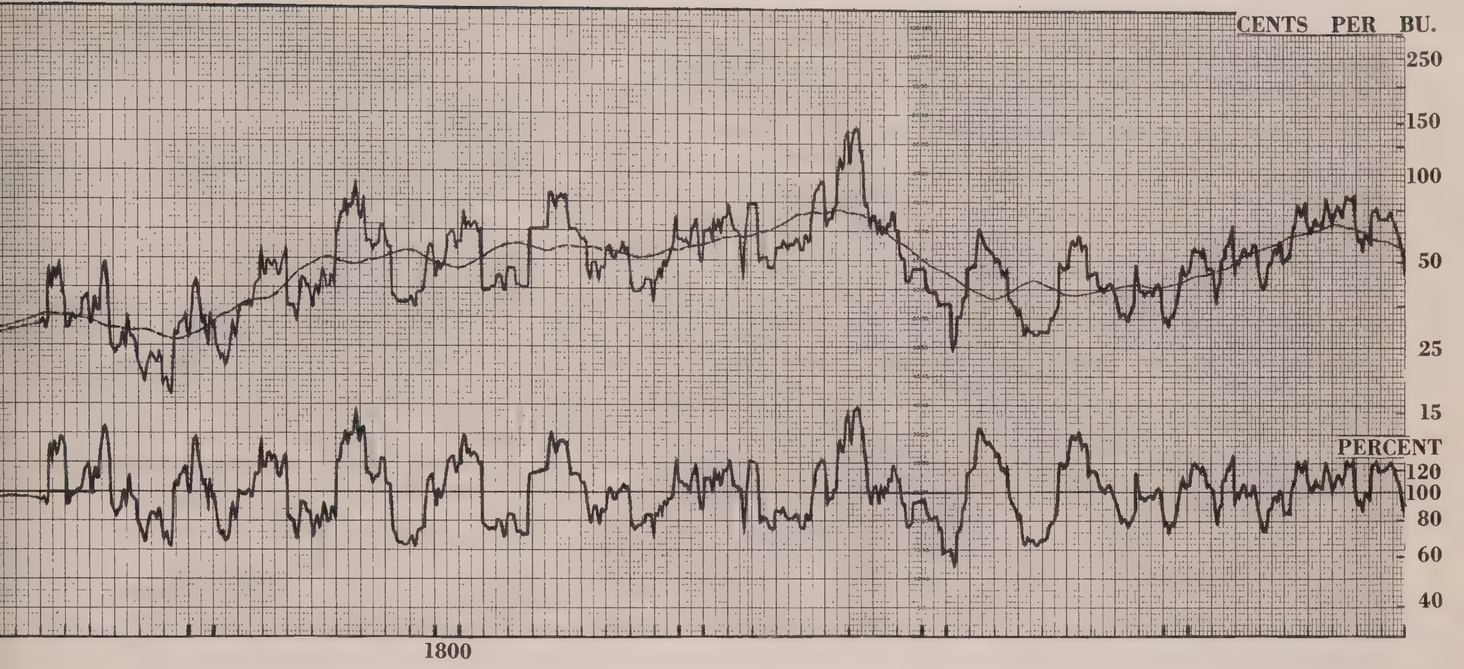


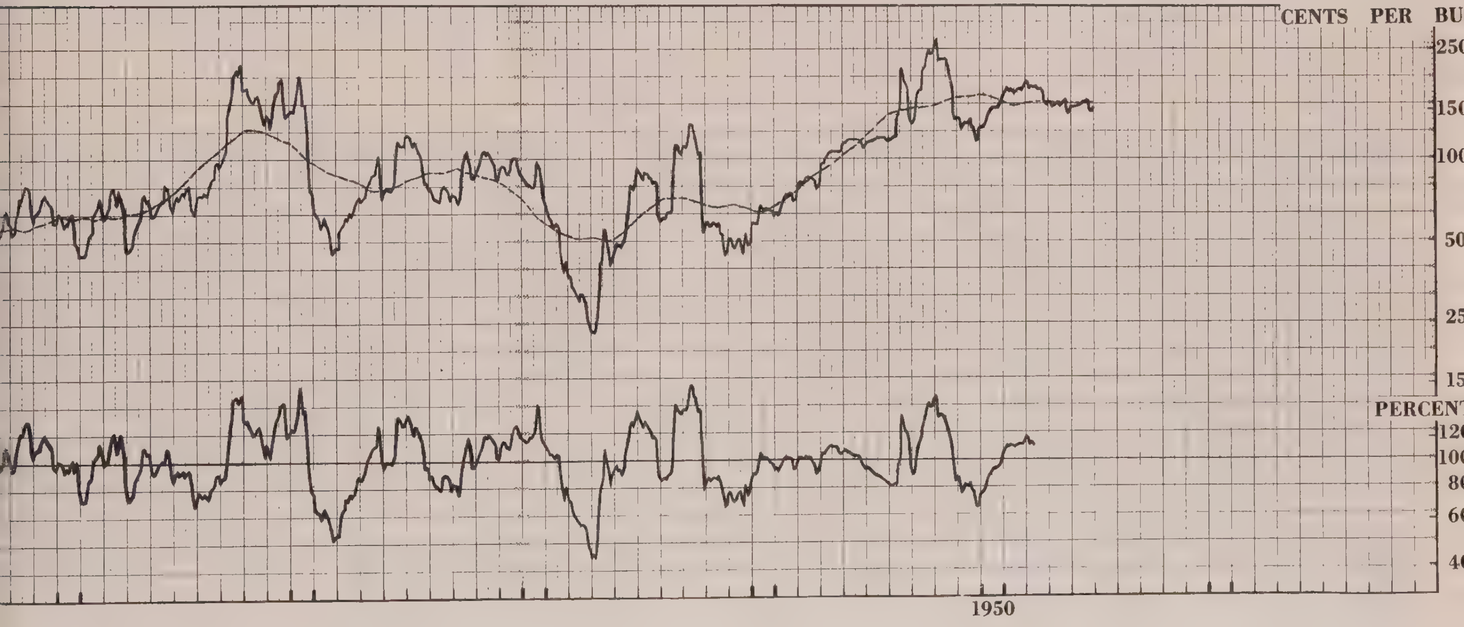
Fig. 1. Corn Prices

Index of corn prices by months January 1720—December 1954 (Curve A), together with trend (Curve B), and percentages by which the index is above or below trend (Curve C). These percentages are called deviations.

Trend is a 65-month geometric moving average. End values extrapolated graphically.

Top half of the chart shows index values January 1720—December 1839. Bottom half of the chart shows index values January





1840—December 1954.

The index represents actual prices at Chicago, January 1858 to date. Prices for recent years are for No. 3 yellow.

Prior to January 1858 the index represents prices at Philadelphia times .618 to make Philadelphia prices comparable to Chicago prices.

Early prices given in shillings are converted to dollars at the rate of 7 shillings 6 pence per dollar.

Missing values for Revolutionary War period interpolated. Ratio Scale.

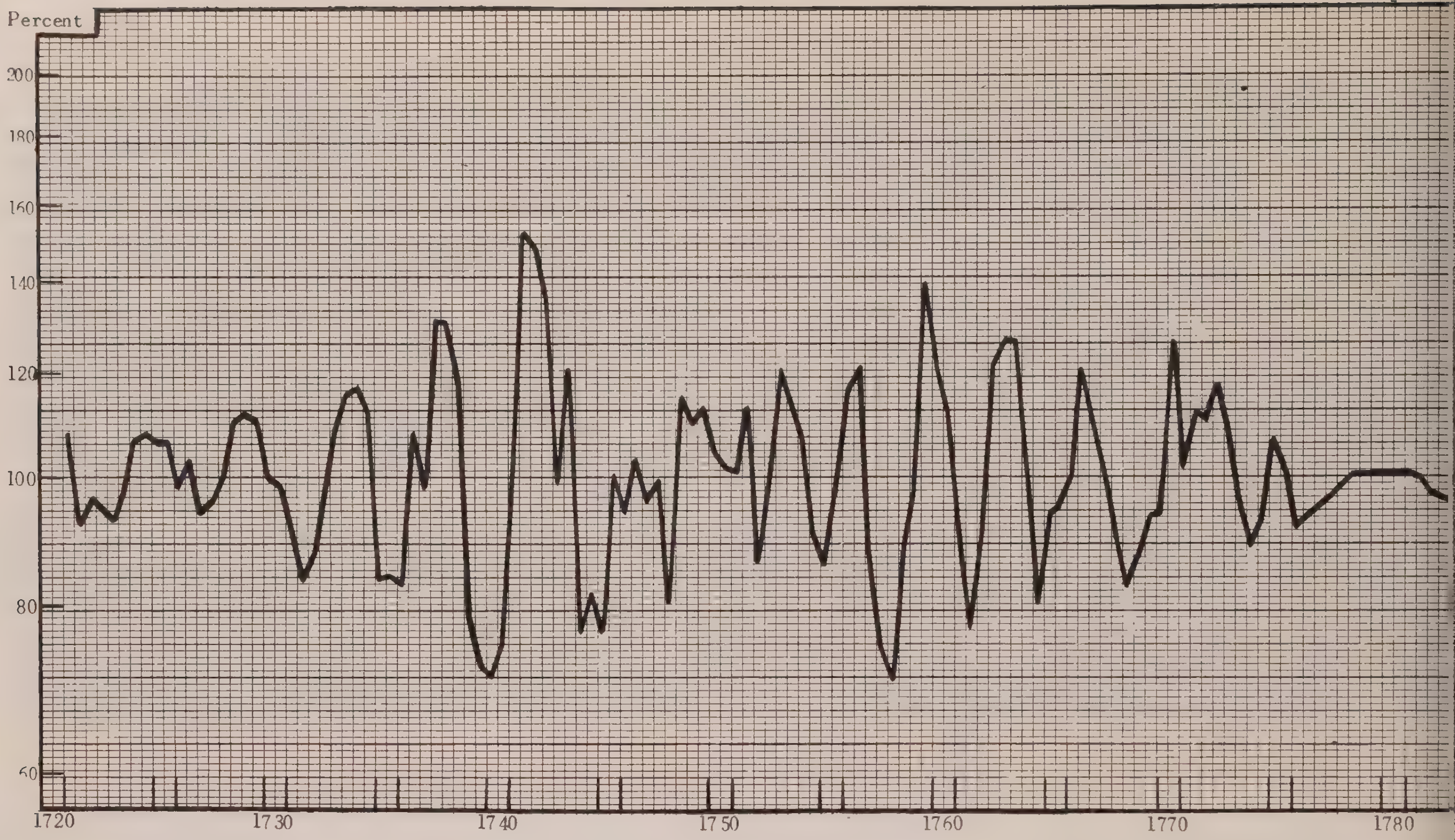


Fig. 2. Corn Price Deviations Represented Semiannually. (See text for explanation.)
Ratio Scale.

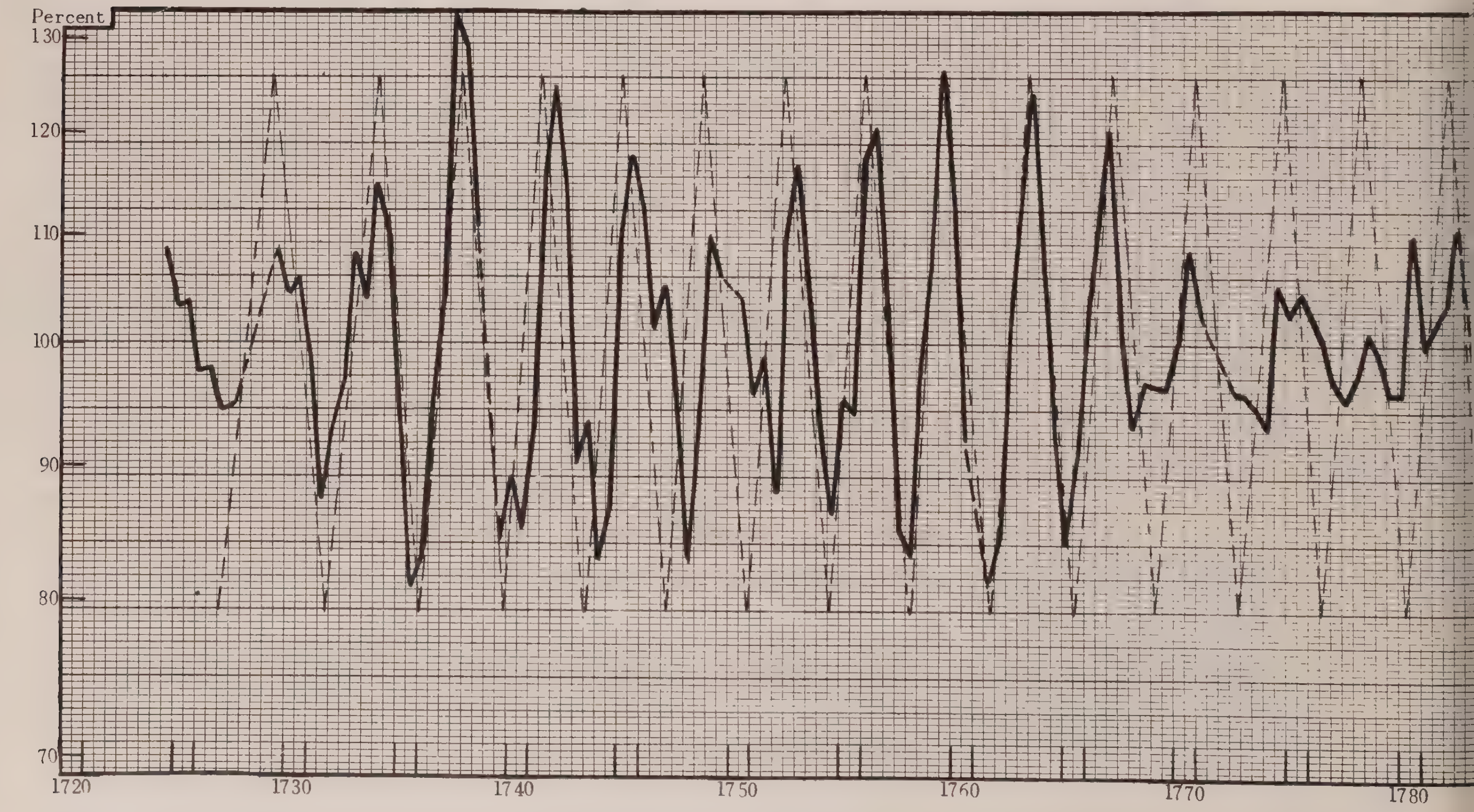
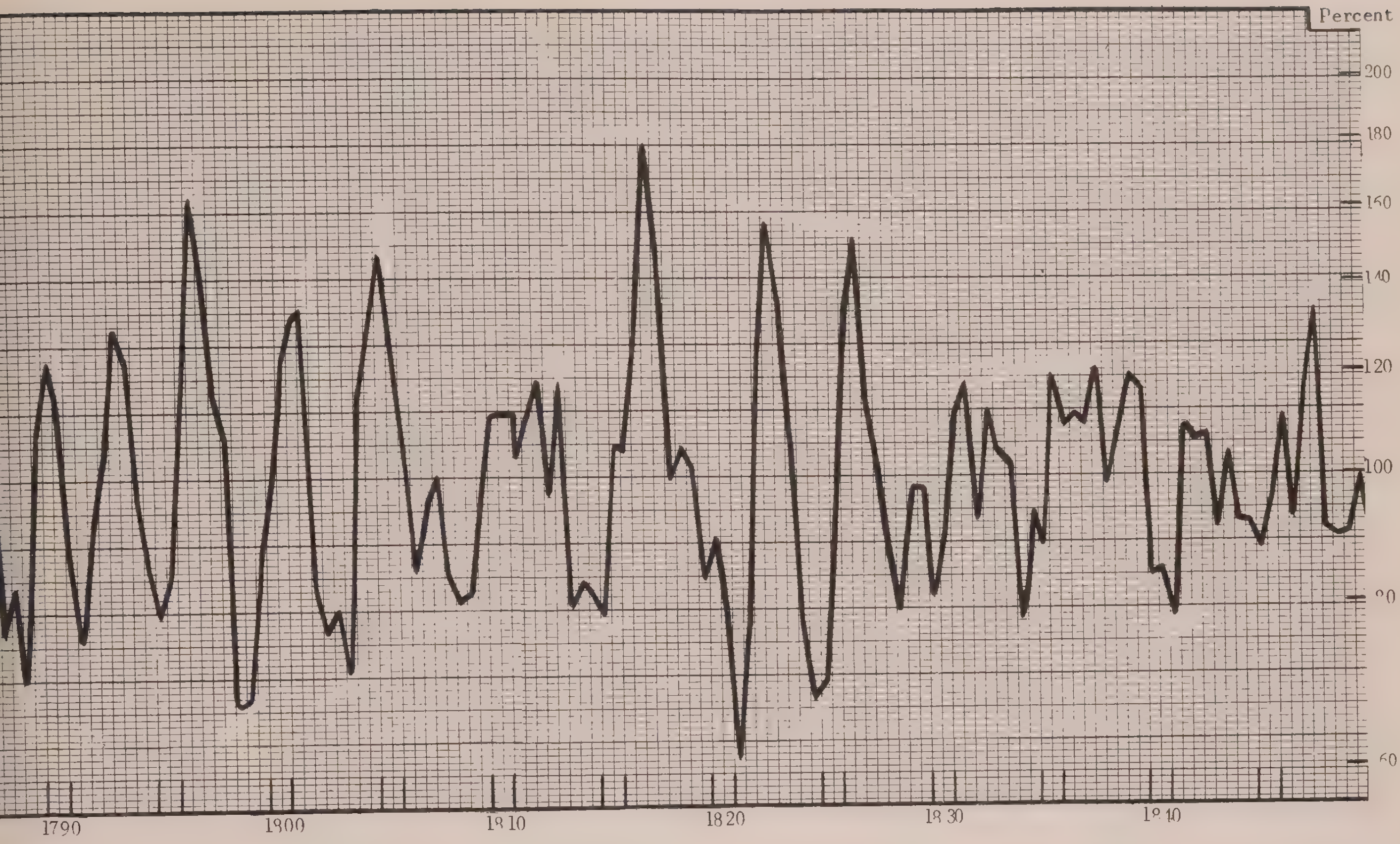


Fig. 3. The 3 2/3-Year Cycle in Corn Prices Derived from Fig. 2. (See text for explanation.)
Ratio Scale.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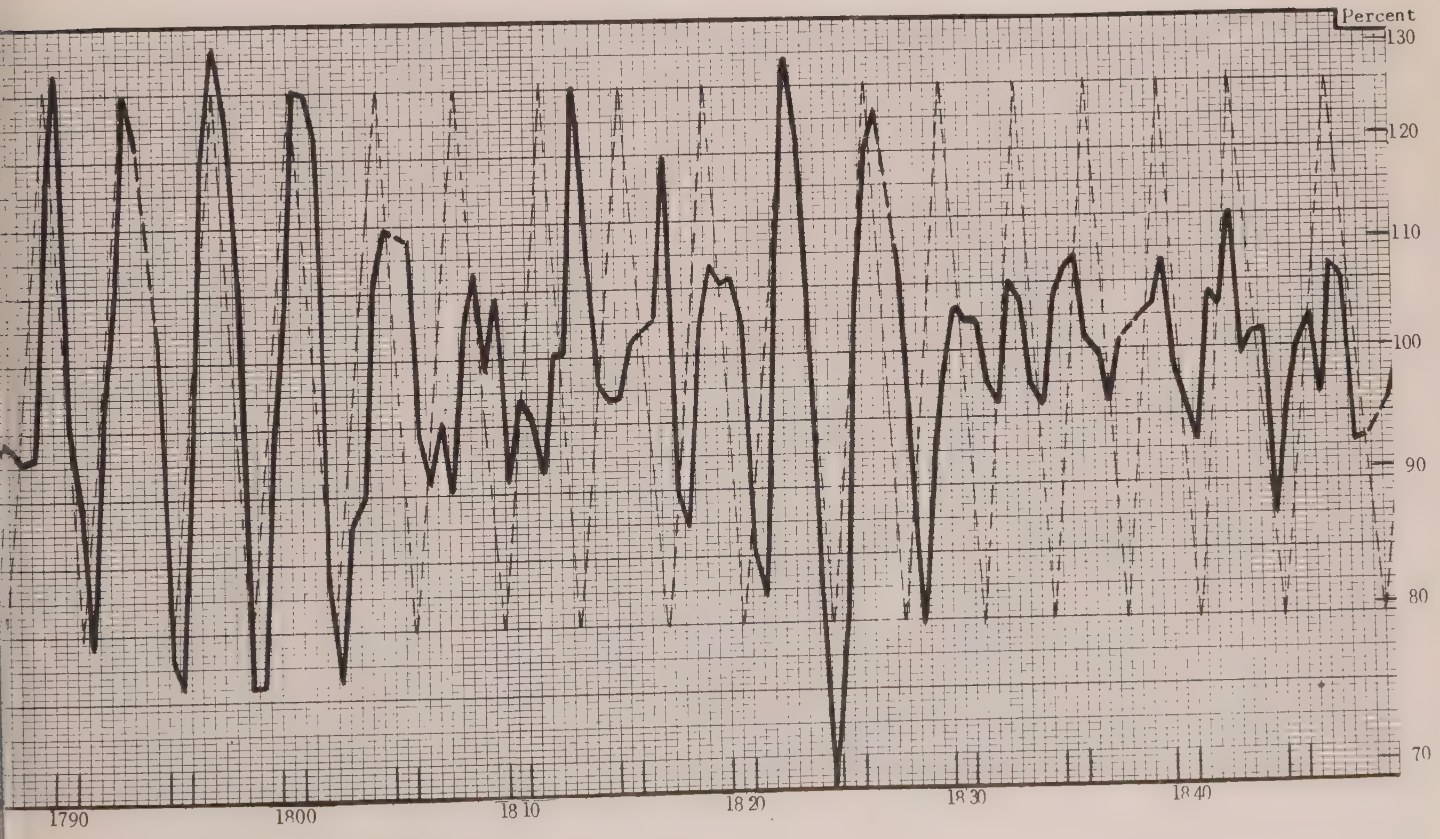
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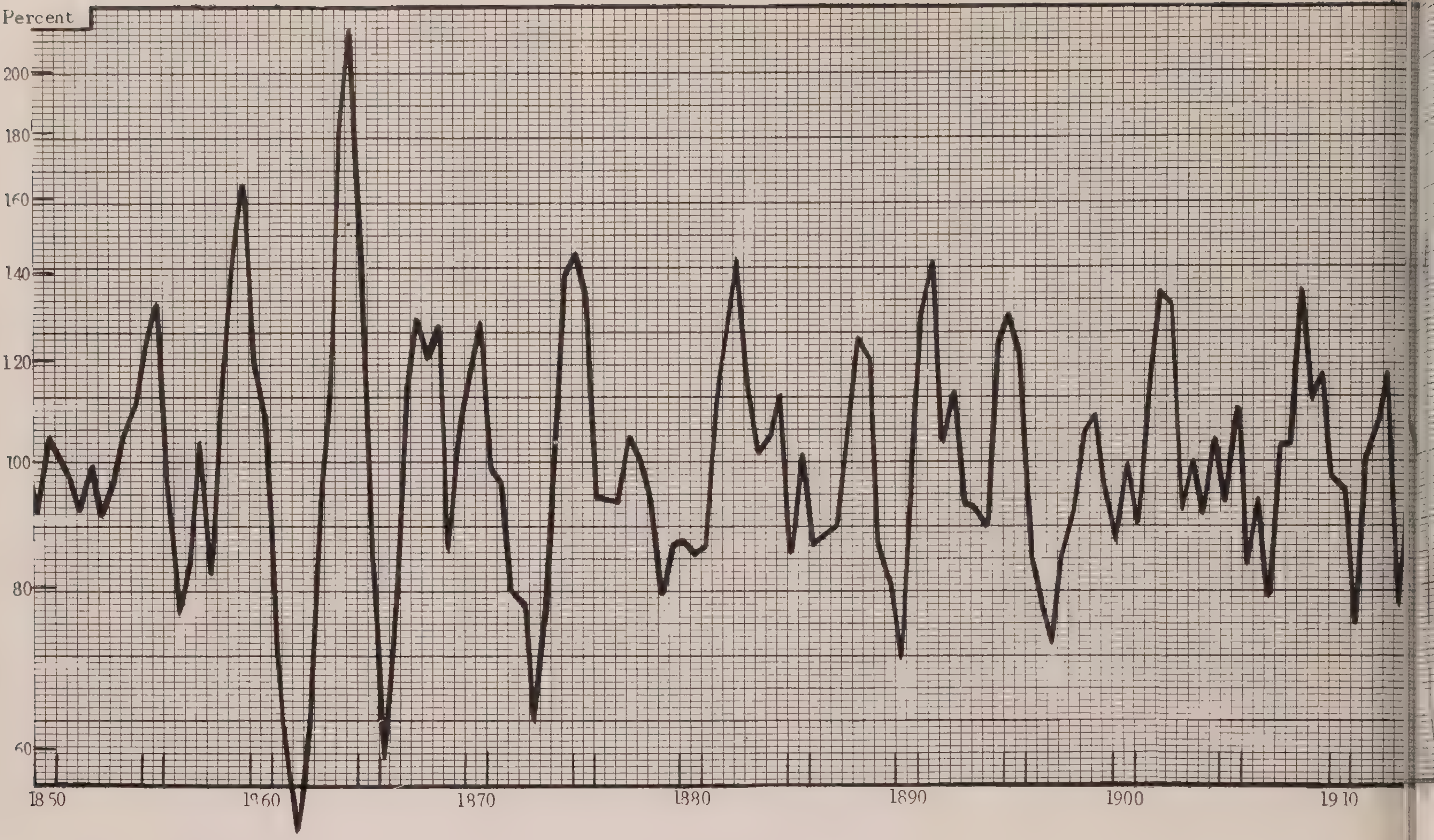


Fig. 2. Continued

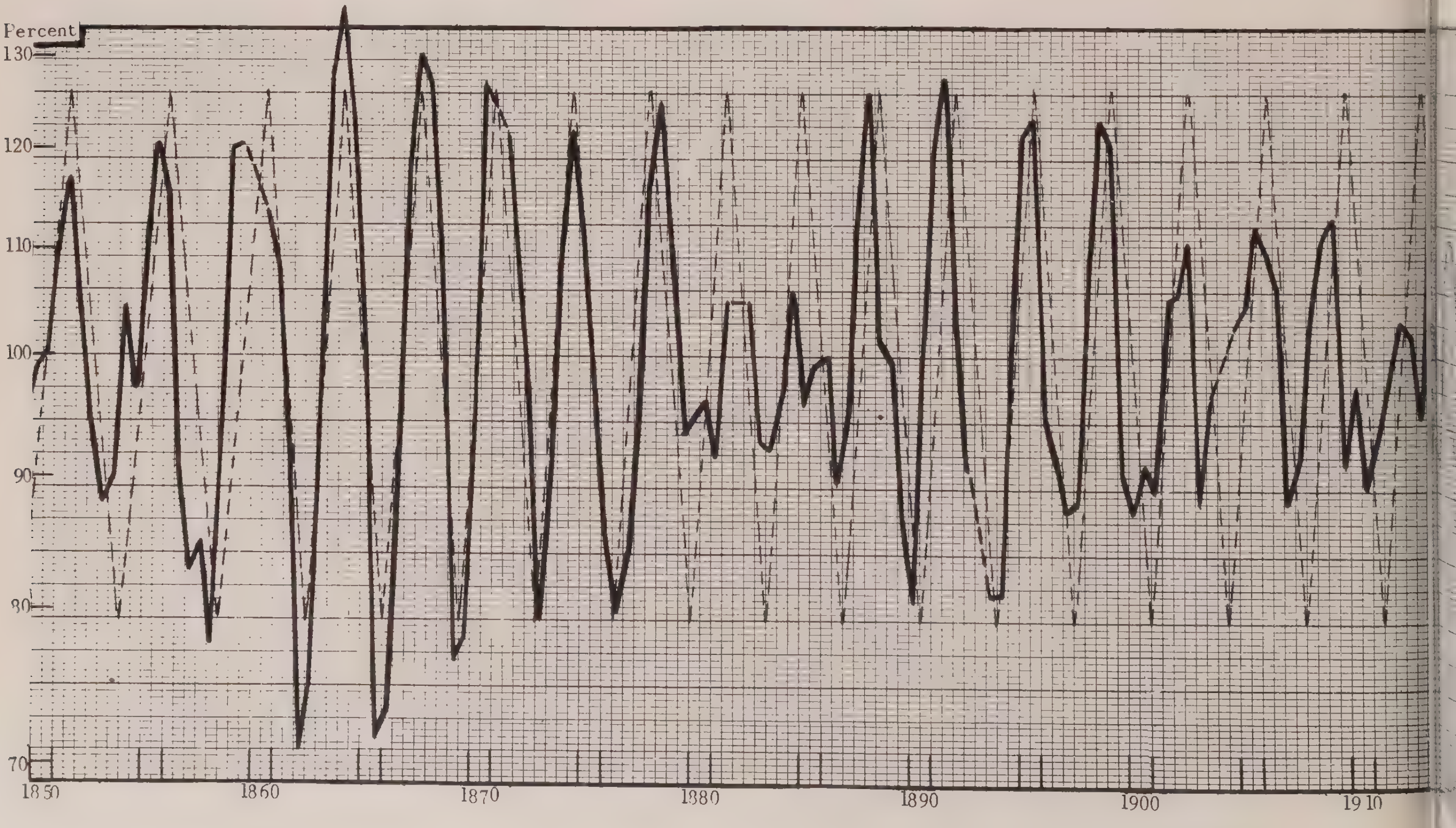
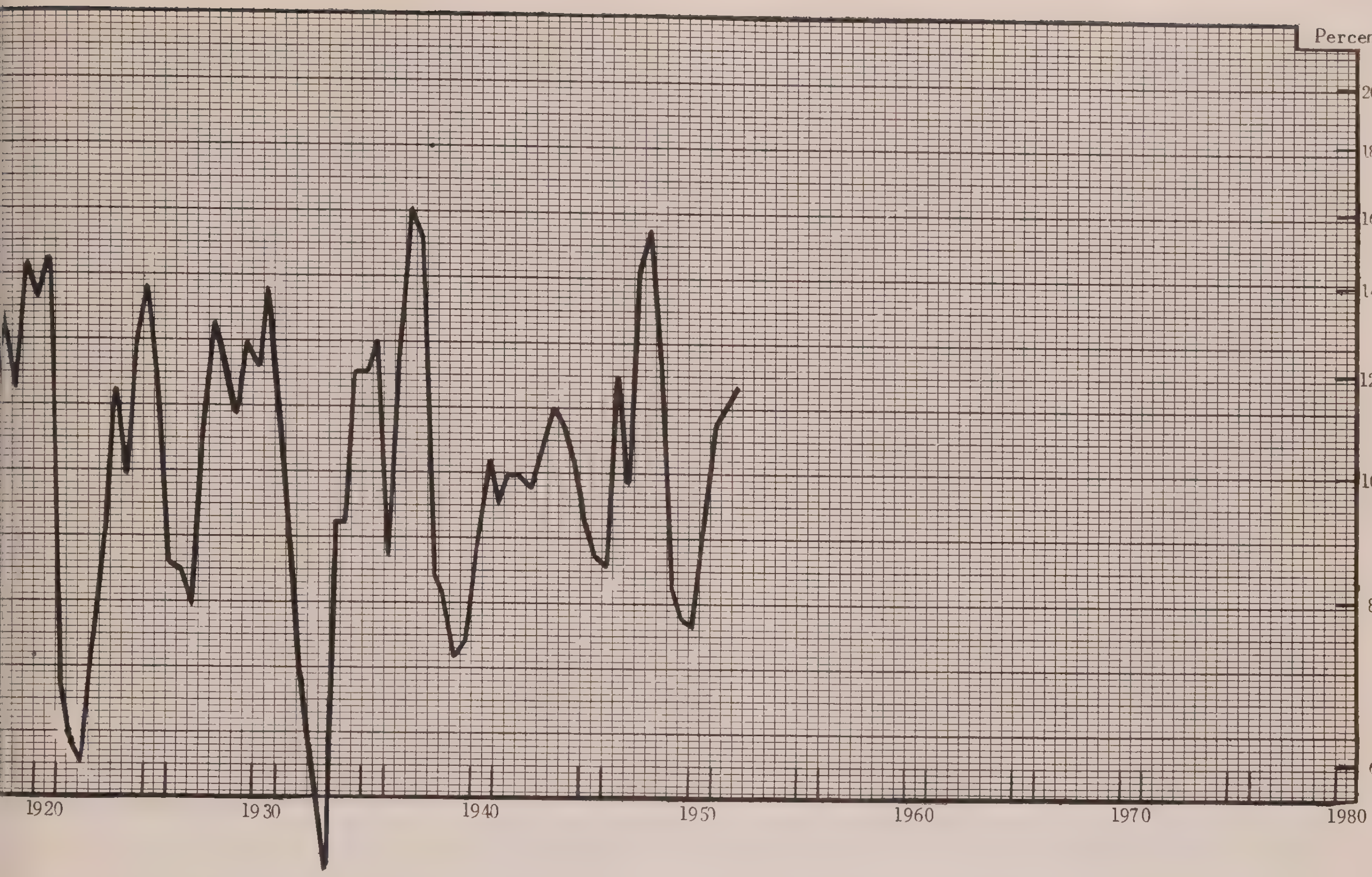


Fig. 3. Continued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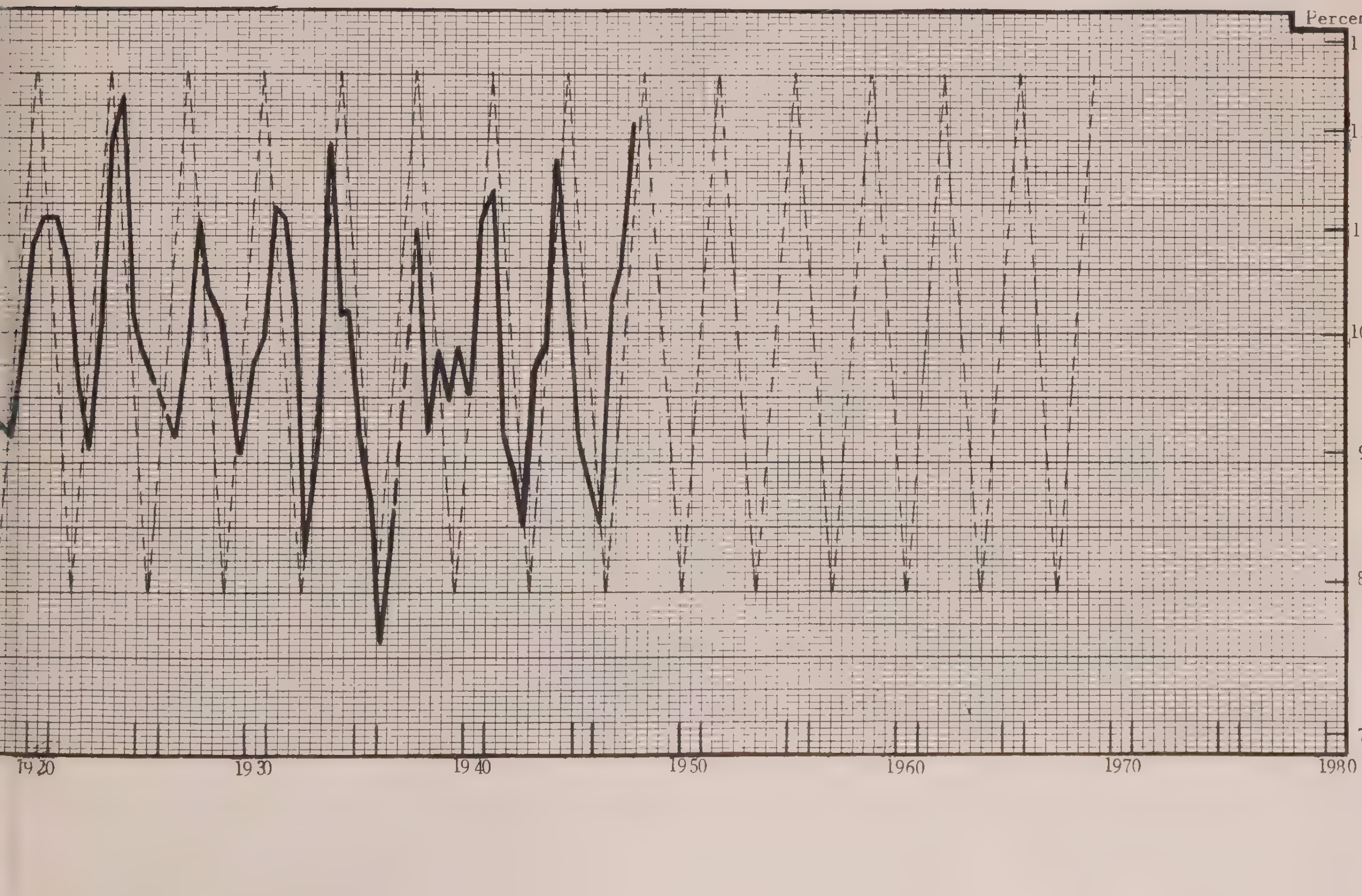
Percent
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business. This business has a pronounced seasonal pattern. Big sales in the summer months, small sales in the winter months. You could get an idea of this pattern by looking at a chart of the sales of just one year. However you could get a better idea of the pattern if you averaged the cycle for two consecutive years. To get this average you would average the two Januarys, the two Februarys, etc. Even better would be to average three Januarys, three Februarys, etc, or even more.

In this averaging process the randoms tend to offset each other, the regular seasonal cycle—insofar as it *is* regular and uniform from year to year—is unaffected.

The same process can be applied to average cycles of any length. And the beauty of the technique is that it does not change the *length* of the cycle even if this length happens to be different from the length of the sections you choose for the experiment.[5]

In our case, because the cycle seems to be about 3 2/3 years long, we chop the figures into sections of this length and average each successive overlapping group of these sections to obtain the values plotted in Fig. 3. This gives us our first real look-see at the 3 2/3-year cycle in these figures.[6]

What is Revealed?

As we look at this curve several things become clear.

First of all we see a definite clear-cut wave motion, first up, then down, marching across the page in orderly sequence.

Second, we notice that the height of these waves varies and that the strong waves and the weak waves tend to come in bunches.

Third, a careful study of the length of the cycle—the time interval between successive wave tops or wave bottoms—shows that the wave length is *not* uniform throughout. (This fact should re-assure those who feel that the process of averaging these consecutive sections *creates* a cycle. It does not create the cycle. It reveals the cycle.)

Manifest Wave Length

What are the wave lengths revealed? (In talking about wave length let us think of the cycle as running from wave top to wave top.)

After two long 4 3/4-year waves from 2nd half 1724 to 1st half 1734 the fluctuations settle down to a steady rhythmic cycle which averages about 3 2/3 years in length and which continues for 25 repetitions to the 1st half of 1826.

Then, suddenly, the length shortens. The cycle becomes 3 1/3 years long for 5 repetitions to the 2nd half of 1842.

Then, just as suddenly, the length lengthens. The cycle becomes 4 1/2 years long for 4 repetitions to the 2nd half of 1860.

Finally the fluctuations settle down to regularity again, only this time, for the 25 repetitions from the 2nd half of 1860 to the last crest on the curve, to a length of about 3 1/2 years instead of about 3 2/3 years, as in the first half of the series.

This is the *manifest* behavior—the behavior that anyone can see by superficial examination. There is clearly no *one* cycle length which dominates throughout. On the other hand the cycle of about 3 2/3 years long which continued for 92 years from 1734 to 1826 cannot reasonably have its regularity merely as the result of chance. Nor can the cycle of about 3 1/2-years which has dominated behavior for the 95 years since 1860. Definitely we have here something which requires further study.

The Next Step

We need to know:

1. What is the exact length of the so-called 3 2/3-year cycle?
2. Is its length perfectly regular, or, when we put it under the microscope, is its length seen to change?
3. If its length changes, is there any thing *orderly* in the way in which it does it?
4. Does the 3 2/3-year cycle continue as a *hidden* factor in the situation after 1826? What will we find when, by statistical techniques, we look *beneath* the surface? Did the 3 2/3-year cycle *vanish*, or was it overwhelmed?
5. Similarly for the 3 1/2-year cycle, what is its exact length?
6. Is its length perfectly regular, or

when put under the microscope is *its* length seen to change?

7. If its length changes, is there anything orderly about the way it does it?

8. What is its exact timing, and where are we in the cycle now?

9. What profit would you have made if you had traded on this cycle for the last 95 years? And how consistent would your profits have been?

10. Was the 3 1/2-year cycle present as a *hidden* cycle prior to 1860, or did it start suddenly at that time?

These are the questions that must be answered before we try to answer the more important question relative to cause which I asked at the beginning of the article.

The answers, as best I am able to give them, will be found in a continuation of this article, to appear in an early issue.

E.R.D.

TECHNICAL

This section is for the technician. The general reader who is not interested in details and in techniques will probably want to skip it.

The Index

1. The Index. Data January 1720, December 1857 come from Cole, *Wholesale Prices in the United States, 1700-1862*. They represent corn prices at Philadelphia. They are multiplied by .618 to make them comparable with prices 1858 to date, which are average prices at Chicago and which come from United States Department of Agriculture. (Prices for recent years are for No. 3 yellow.) Early prices, given in shillings, are converted at the rate of 7½ shillings to the one dollar.

The Plotting

2. Actual points plotted are logs of price index computed as in Note 1 above. The curve is thus the same as you would get by plotting the actual index on semi-log or ratio ruling of suitable scale. Anti-log scale has been added so that values can be read directly in cents per bushel.

The Trend

3. The trend is a 65-month geometric moving average. The value for each month in the 65th root of the product of the 65 numbers centering at that month. That is, it is the anti-log of the simple arithmetic 65 month moving average of the logs of the data.

Values for the 32 points at each end of the series which are lost by this process have been determined by graphic extrapolation.

The Semi-Annual Averages

4. The semi-annual averages are averages of the logs—in other words the sixth root of the product of the six price index values involved.

The averages are by crop year, November-October inclusive. Thus the first value, plotted at 1st half 1921, is an average of values for November and December 1720, and for January through April 1721. The second value, plotted at 2nd half 1721, is an average of the values May-October 1721.

5. See Dewey, E. R. and Dakin, E. F., *Cycles—The Science of Prediction*, Appendix III.

The Periodic Table

6. Three and two-third years are seven and one-third half years. The values are therefore entered into a periodic table in which the lines are 7, 8, 7, 7, 8, 7, 7, 8, 7, etc. items long. Three year moving averages are then computed of each *column*. This gives us the desired result. See Table 1 and Table 2 on the following page.

Randoms

7. Of course the process tends to create a transient evanescent cycle of the same length as the length of the section. The process divides each random by three,

leaving one third of the random at its original position, and depositing the other thirds at 7 or 8 half years before and 7 or 8 years after the original position, respectively. Insofar as these values are not offset by other randoms a spurious cycle of the length of the sections is created, but, for any one random, *for only* two waves. Of course other randoms will create other spurious cycles for two waves only, but the various spurious cycles will not be in step with each other, except by chance. To attribute the 26 rhythmic repetitions shown by Fig. 3 to chance is unrealistic.

Table 1

Index of Corn Prices

7 1/3-Year Periodic Table of Logs of Index (Fig. 2)

Base Half Year	Half Years After Base Half Years							
	1	2	3	4	5	6	7	8
2nd half 1720	2.032	1.964	1.983	1.975	1.967	1.990	2.029	
1st half 1724	2.034	2.027	2.026	1.993	2.012	1.973	1.982	2.001
1st half 1728	2.043	2.047	2.043	1.999	1.994	1.961	1.921	
2nd half 1731	1.942	1.991	2.038	2.063	2.068	2.048	1.923	
1st half 1735	1.925	1.920	2.033	1.990	2.119	2.117	2.070	1.893
1st half 1739	1.857	1.850	1.875	2.004	2.183	2.171	2.135	

etc.

Table 2

Index of Corn Prices

Three 7 1/3-Half-Year Section Moving Average of Logs of Index (Fig. 3)

Base Half Year	Half Years After Base Half Years							
	1	2	3	4	5	6	7	8
2nd half 1720	—	—	—	—	—	—	—	
1st half 1724	2.036	2.013	2.017	1.989	1.991	1.975	1.977	x
1st half 1728	2.006	2.022	2.036	2.018	2.025	1.994	1.942	
2nd half 1731	1.970	1.986	2.038	2.017	2.060	2.042	1.971	
1st half 1735	1.908	1.920	1.982	2.019	2.123	2.112	2.043	x

etc.

CYCLES IN CONTINENTAL OIL COMPANY INCOME

IN 1949 I made a study of the gross operating income of Continental Oil Company. This study was published in December 1950. It showed a clean-cut 6-year cycle. This cycle is still coming true. See Fig. 1 below.

The 6-Year Cycle

Fig. 1 diagrams the cycle and shows, by means of a light dashed zigzag line, the typical time of high and low as determined at that time. The solid line gives income as percentages above and below trend. It has been brought up to date with a heavy black line. Ideally the 6-year cycle has a crest in 1948 and every six years before and after that time. It has clearly continued to dominate.

The Study Expanded

In 1953 the study of Continental Oil Company income was expanded. The timing was left unchanged, but with more figures it was possible to improve the typical

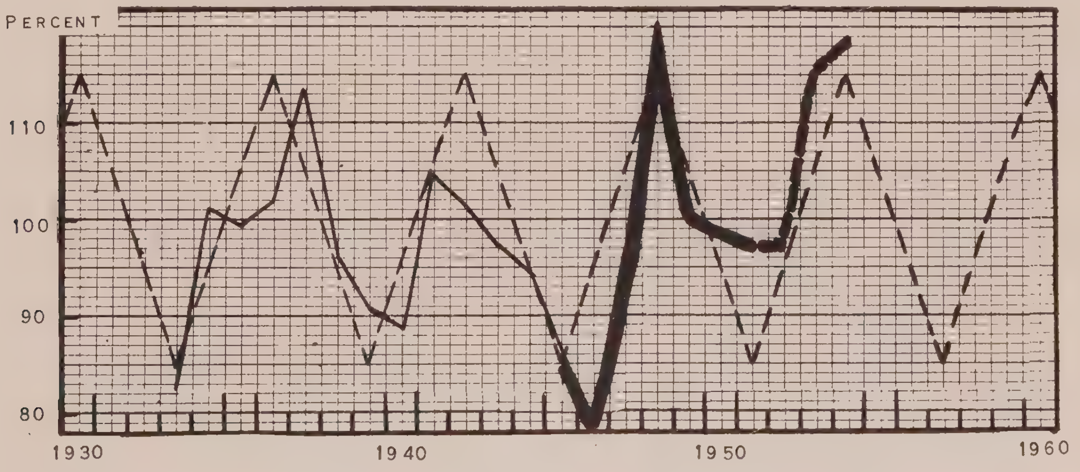


Fig. 1. The 6-Year Cycle in Continental Oil Income

Solid line shows percentages above and below trend.

Thin solid line shows these percentages as charted in the original study.

Heavy solid line shows how the cycle has worked out. For the last three years the percentages are shown by a broken line because we cannot know trend for sure later than 1951.

Broken line diagrams the *timing* of the 6-year cycle as determined and projected in the original study.

shape and strength of the 6-year cycle. A 3 1/2-year cycle was discovered. A trend was added to the work to make a more realistic forecast of future company income. This second study was published in our report for June—July 1953.

The 1953 Forecast

Based on 1952 sales of $397.2 million, the article suggested that income might go up to $414 million in 1953 and up further to $483 million in 1954, then turn down. The summary chart from the 1953 article is reprinted here as Fig. 2. It too has been brought up to date with a heavy black line. Actual income in 1953 was $479.8 million. Actual income in 1954 was $500.1 million.

The fact that 1953 sales were above the forecast led me to think ,in 1954, that my trend was too flat. At that time only one additional year had been added to Fig. 2 and it looked as though the departure from the forecast was too great.

The 1954 Forecast

So, in 1954, I revised the trend upward. The two cycles were re-evaluated and a revised forecast was published in our June—July 1954 report. This 1954 forecast is printed below in Fig. 3. It is not as good as the forecast of 1953! I would have done better to have let well enough alone.

The typical 6-year and 3 1/2-year cycles which were used in 1954 forecast are included here as Figures 4 and 5.

Figure 6 combines the two cycles and compares them with actual departures from the 6-year trend. Again it has been brought up to date. The additional years do not suggest any change of the cycle patterns at this time.

Conclusion

If the cycles are significant and continue, we should expect that the gross operating income of Continental Oil Company will be down for the next three years or so. *E.R.D.*

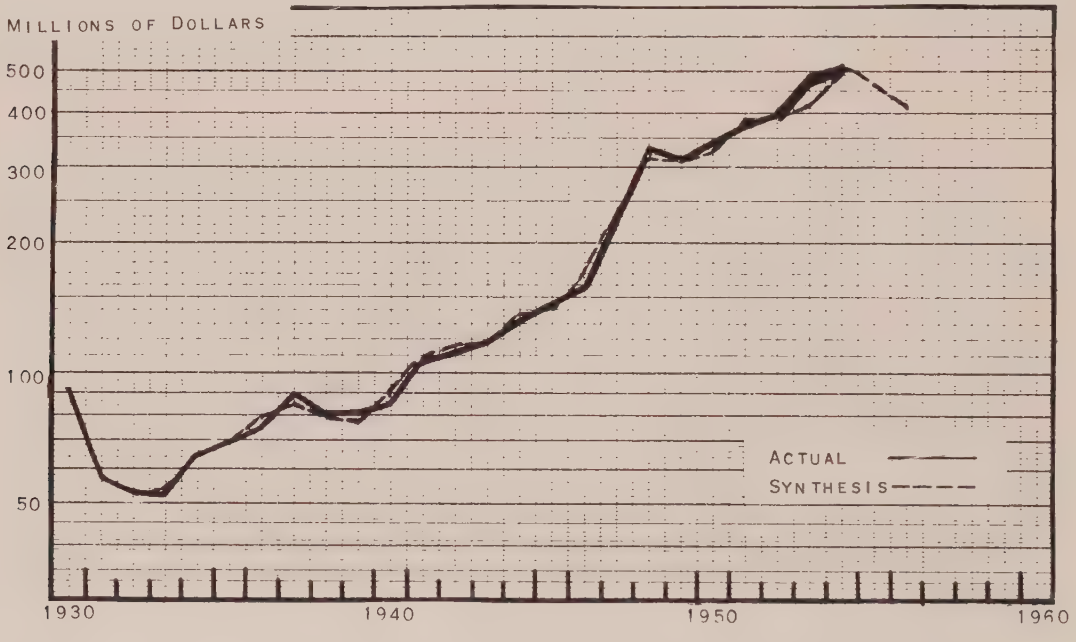


Fig. 2. Continental Oil Company Income and 1953 Forecast

Solid line shows actual gross operating income, Continental Oil Company, 1930-1954.
Income since the forecast shown in heavy black line.
Broken line shows combination of (a) 6-year cycle, and (b) 3½-year cycle and (c) trend, as determined and projected early in 1953.

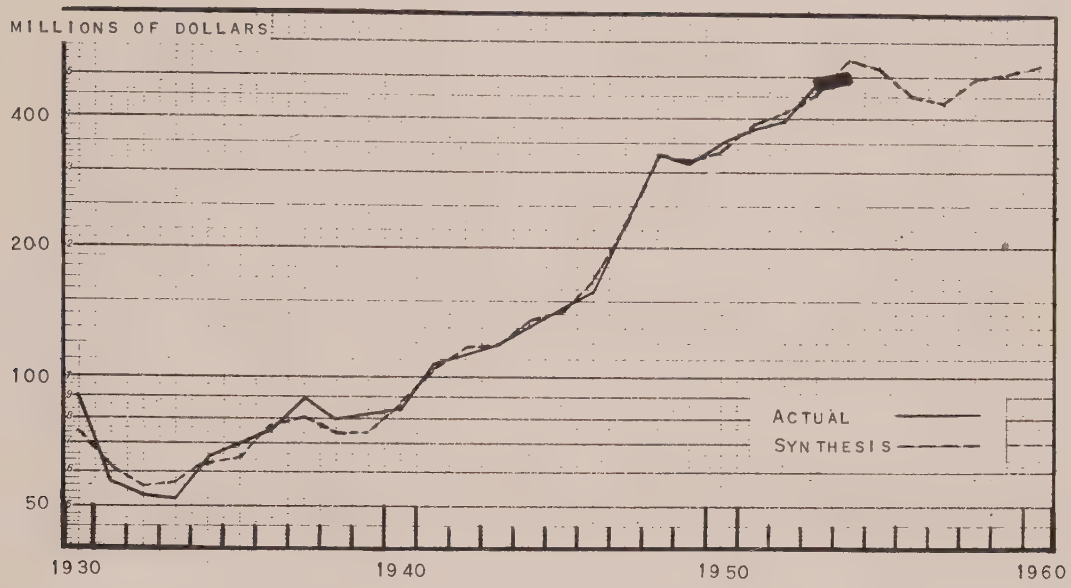


Fig. 3. Continental Oil Company Income and 1954 Forecast

Solid line shows actual gross operating income, Continental Oil Company, 1930—1954.

Broken line shows combination of (a) 6-year cycle, (b) 3 1/2-year cycle and (c) trend as determined and projected in 1954. Seemingly two vigorous a trend was used for 1954. The 1953 trend gives a better fit. Either projection suggests that, if the cycles continue, income may decrease for the next three years.

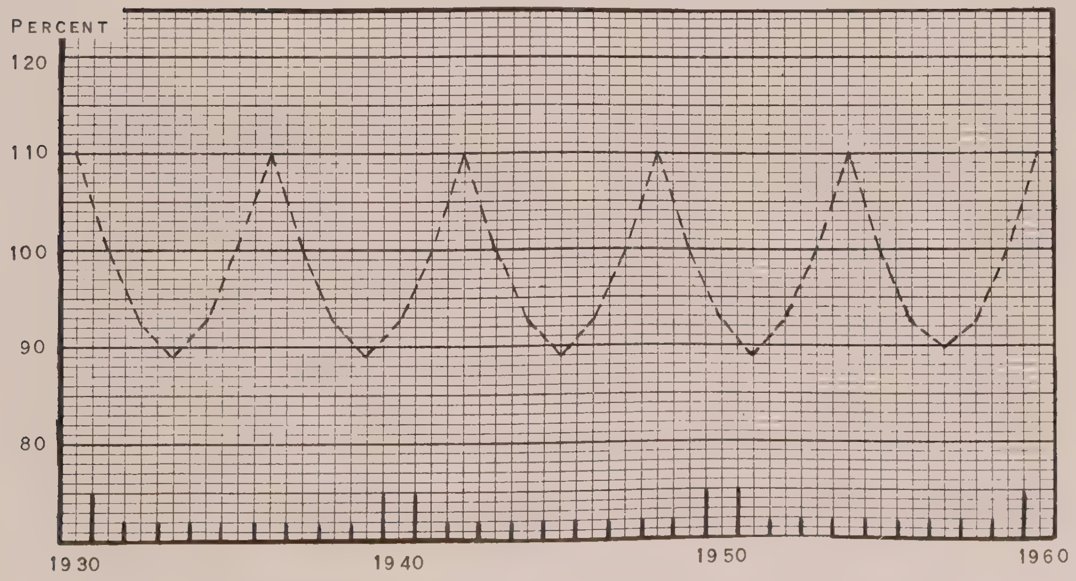


Fig. 4. The Typical 6-Year Cycle in Continental Oil Income

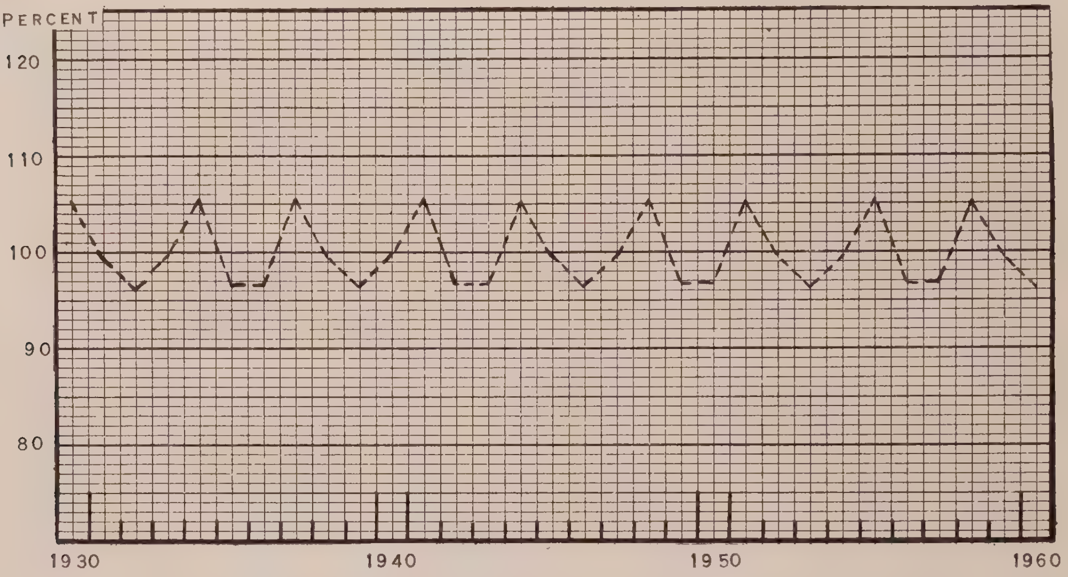


Fig. 5. The Typical 3½-Year Cycle in Continental Oil Income

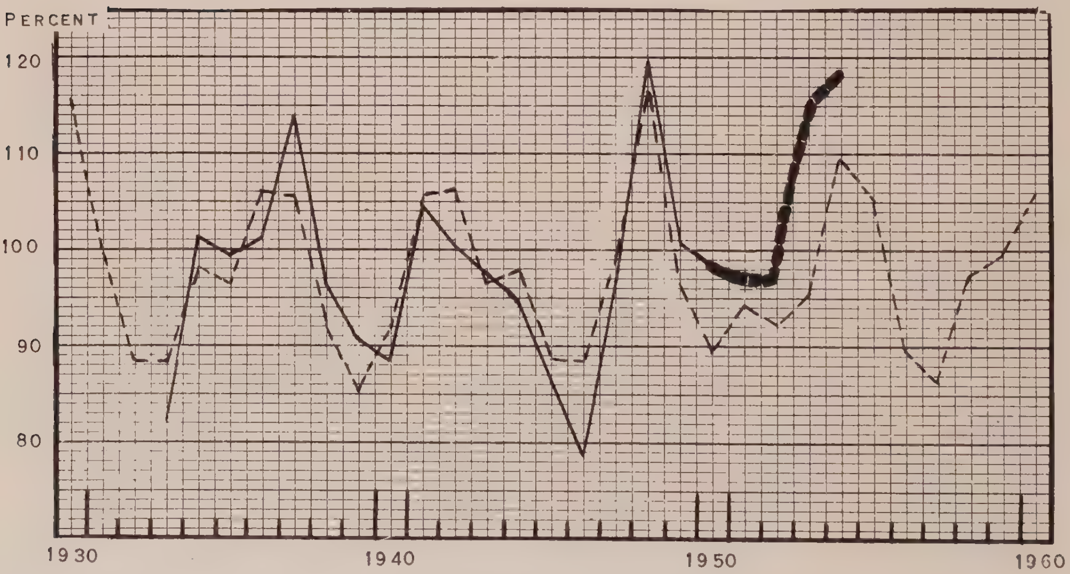


Fig. 6. Combination of the Typical 6-Year and 3 1/2-Year Cycles in Continental Oil Income

Broken line shows the synthesis of these two cycles.

Light solid line shows percentages by which actual income was above or below trend.

Heavy solid line, 1950-1951, shows how curve has unfolded since these two cycles were isolated.

Heavy broken lines, 1951-1954, shows percentages above and below *estimated* trend. (We cannot yet know trend for certain past 1951.)

This finger painting is composed entirely of rhythmic cycles. However, just try to unscramble it!

It is intended to picture the complexity of cycles, and to show why cycle analysts are intrigued by glimpses of regularity, frustrated by their inability fully to learn the laws which govern it.

THE MODIFIED GEISINGER INDICATOR

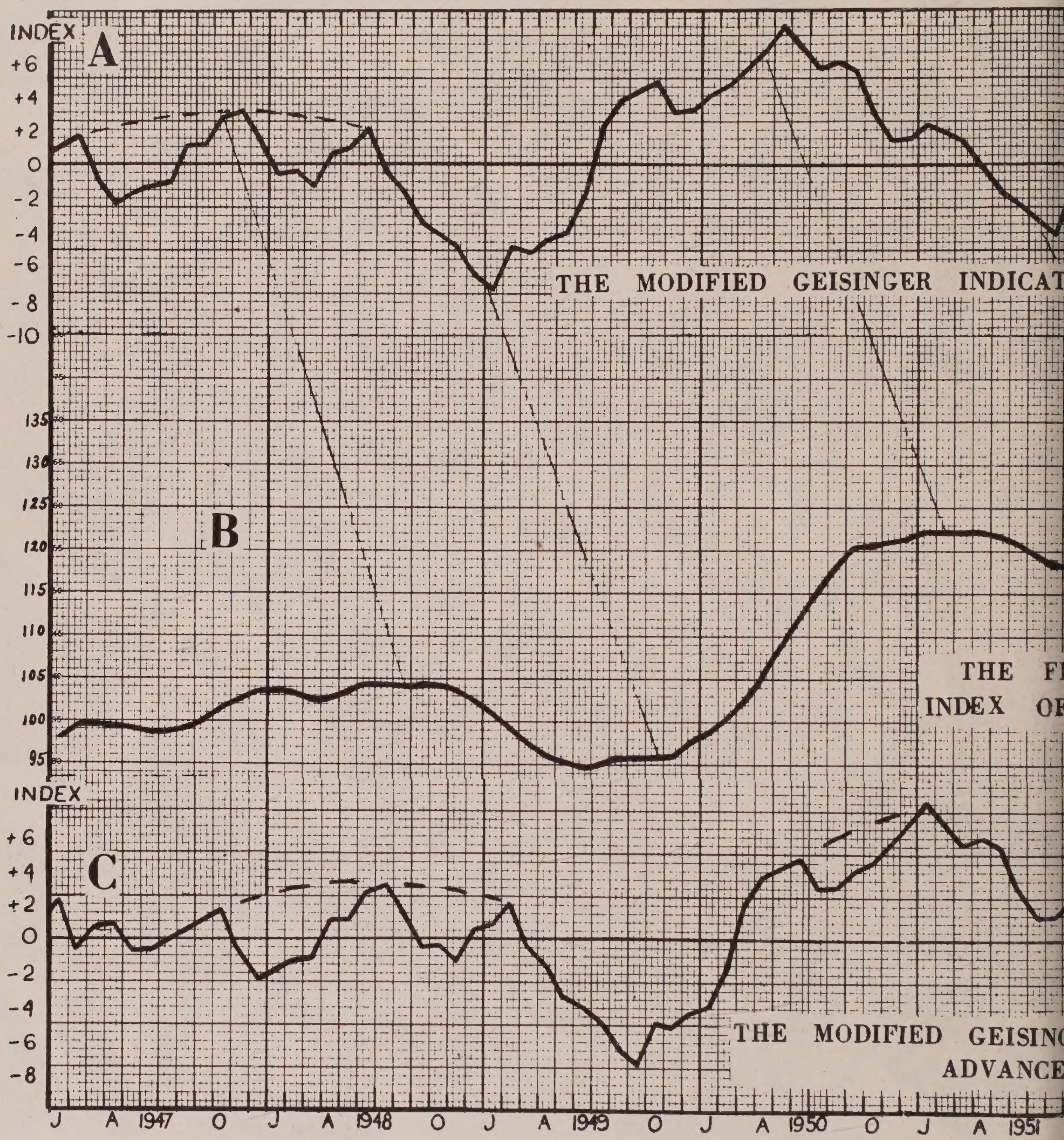
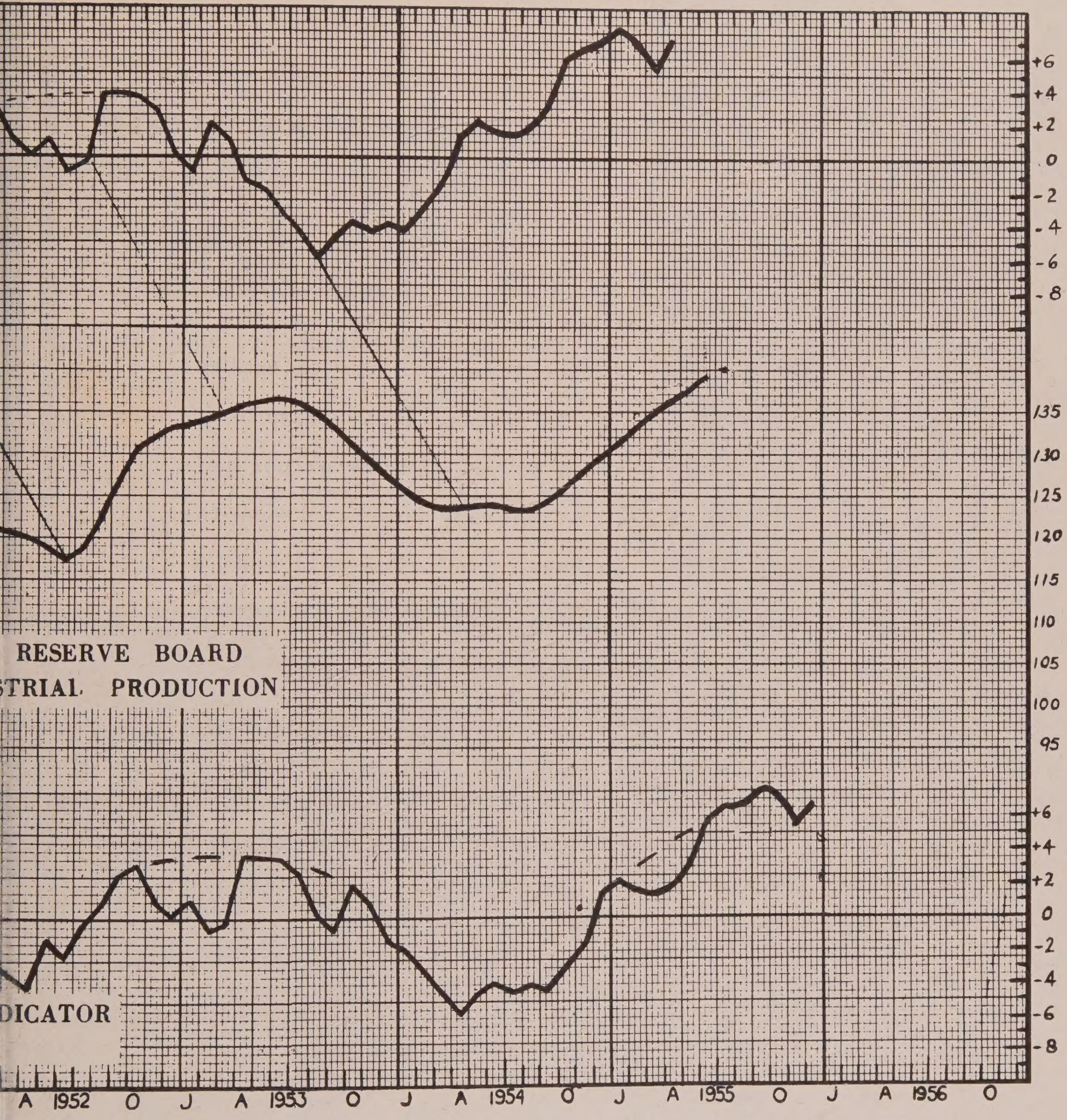


Fig. 1. Curve A. The Modified Geisinger Industrial Production Indicator Curve. This curve is derived from certain figures which are published monthly in the *Survey of Current Business*. It tends to turn about 8 months before the Federal Reserve Board Index of Industrial Production.

Curve B. The Federal Reserve Board Index of Industrial Production adjusted for seasonal variation and smoothed by a 3-month moving average. The value for the latest available month is shown by a dot.

Curve C. This Curve is the Modified Geisinger Industrial Production Indicator Curve advanced by 8 months. This process projects part of the curve into the future. If the relationships of the past continue, the projection gives some hint of what may happen to the Federal Reserve Board Index of Industrial Production (Curve B).

OF INDUSTRIAL PRODUCTION



THE FORECAST

The final figure for April (which, when projected, becomes December) is 6.6. This is a sharp advance from the value of 5.4 for the previous month.

This advance from March to April suggests that the decline from January to March may have been similar to the decline from October 1949 to November 1949, or February 1952 to June 1952. These were minor declines which had no significance.

I would say we need values for another month before we can know one way or the other.

In the meantime my own feeling for the near future is one of optimism still tinctured with caution.

E.R.D.

Mr. H. A. Musham
741 No. Rush St.
Chicago, Ill.

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